

## Evolution of Oxygen Isotopes in the Solar Nebula

James Lyons<sup>1</sup> and Edward Young<sup>2</sup>

(Email: jrl@ess.ucla.edu)

<sup>1</sup>Institute of Geophysics and Planetary Physics, University of California, Los Angeles, California

<sup>2</sup>Department of Earth and Space Sciences, University of California, Los Angeles, California

The oxygen isotope systematics of highly refractory calcium-aluminum inclusions (CAIs) in primitive meteorites has defied explanation for over 30 years. The mass-independent fractionation (MIF) of the rare isotopes,  $^{17}\text{O}$  and  $^{18}\text{O}$ , was originally interpreted as supernova input of pure  $^{16}\text{O}$  into the solar nebula, but the lack of similar fractionation in other elements argues against this scenario. A chemical MIF mechanism, analogous to that during ozone formation, may have occurred during gas-phase silicate reactions in the inner solar nebula, but experimental evidence for MIF in such reactions is lacking. Recently it was suggested that self-shielding of CO in the innermost solar nebula produced the MIF, but high temperatures in this region would have rapidly erased the MIF signature. Here we report time-dependent photochemical calculations of CO self-shielding in the cooler, surface region of a turbulent nebula, and demonstrate that substantial MIF in bulk oxygen isotopes in the nebula was possible on timescales of 0.1 to 1 Myr. This mechanism provides a self-consistent explanation for the oxygen isotope values of nebular water inferred from secondary minerals in unequilibrated chondrites, and places constraints on key nebula parameters.

